SUMIYO NISHIGUCHI

CATEGORICAL AND SEMANTIC AMBIGUITY OF POSSESSITVES AND ADJECTIVES*

1 INTRODUCTION

This paper examines categorical, structural, and semantic ambiguities of prenominal possessives and adjectives. The first part of this paper discusses the following ambiguities and presents context-free grammar: when two adjectives modify a noun, the second adjective can be categorically ambiguous between an adjective and a noun. Double prenominal possessive (genitive) phrases can also be parsed in two ways: the first genitive phrase may either modify the noun in the following possessive phrase or modify the noun that two possessives modify. The second part of this paper addresses meaning disambiguation of the Japanese genitive marker. Since relations denoted by the Japanese possessive marker are highly ambiguous, I propose type-raising of not only a possessee noun (Partee 1997, Vikner and Jensen 2002) but also a possessor noun, depending on its Qualia Structure (Pustejovsky 1995).

2 UNDERSPECIFIED MEANING

Natural language can be interpreted ambiguously. For example, an English word *bank* is polysemous, such that *I am going to a bank* can be understood as either that the speaker is going to the Bank of America or to a riverside. In addition to such *lexical ambiguity*, natural language contains *scopal ambiguity*. The semantic scope between *everyone* and *someone* is ambiguous in *Everyone loves someone*: when *everyone* takes higher scope over *someone*, there would be different lovers for everyone, while when *someone* takes scope over *everyone*, there is a unique lover that everyone loves. Moreover, pronouns are referentially ambiguous.

In view of such ambiguities, an intermediate ambiguous representation of a natural language has been suggested in the literature (van Deemter 1991, Poesio 1991, 1996). Poesio (1996) presents grammars that generate lexically, scopally and referentially

* Thanks to Chris Barker for useful discussions and comments and to Norihiro Ogata, Amanda Stent, Eric Villemonte de la Clergerie, and Yukio Oba for valuable suggestions at different stages.

Y. Oba & S. Okada (eds.) Osaka Univ. Papers in English Linguistics, 11, 2006, 73-83.

underspecified languages.

Section 2 of this paper discusses *categorical* and *syntactic* ambiguities which Poesio (1996) does not discuss to any great extent. Double prenominal possessives and adjectives are categorically and structurally ambiguous. Section 3 analyzes *semantic* ambiguities of possessive relations and proposes type coercion based on the argument structure of the possessor noun. While Vikner and Jensen (2002) adopt the Qualia Structure (Pustejovsky 1995) of a possessee noun, the possessive relation disambiguation in Japanese calls for type raising of a possessor noun into a one- or two- place predicate.

3 Categorical and Structural Ambiguities of Double Prenominal Possessives and Adjectives

3.1 Categorical Ambiguity between Noun and Adjective and Rewrite Rules

3.1.1 Categorical Ambiguity between Noun and Adjective When two adjectives modify a noun, the second adjective can be categorically ambiguous between an adjective and a noun. In (1), *yellow* may modify: (b) the noun *gold* and the NP *yellow gold* becomes an adjectival phrase that modifies *ring*, so *yellow gold ring* is a ring made of yellow gold or, (c) the noun phrase *gold ring*, in which *gold* is an adjective, and the entire noun phrase refers to a gold ring painted in yellow. *Gold* is categorically ambiguous between a noun and an adjective.

(1) a. yellow gold ring
b. $[_{NP}\ [_{NP\rightarrow AP}\ [_{Adj}$ yellow$][_{NP}$ gold$]]\ [_{NP}$ ring$]]$
c. $[_{NP}\ [_{Adj}$ yellow$][_{NP}\ [_{NP\rightarrow Adj}$ gold$][_{NP}$ ring$]]]$

Similarly in (2), when *royal* modifies a noun phrase *purple gown*, *royal* is an adjective as in (2b). The gown is of the kind that royal families would wear even though the color itself does not have any significance. On the other hand, *purple gown* can form a complex noun phrase as in (2c), where *purple* is a noun modified by *royal*. The gown is a regular night gown but with a royal-looking purple color.

(2) a. royal purple gown
b. $[_{NP}\ [_{NP\rightarrow AP}\ [_{Adj}$ royal$][_{NP}$ purple$]]\ [_{NP}$ gown$]]$
c. $[_{NP}\ [_{Adj}$ royal$]\ [_{NP}\ [_{NP\rightarrow Adj}$ purple$]\ [_{NP}$ gown$]]]$

Color terms and materials tend to be ambiguous even without preceding another adjective (3), and it is well known that national names are categorically ambiguous (4).

(3) $[_{NP}\ [_{NP \rightarrow Adj}$ brick] $[_{NP}$ wall]]^{1}

(4) a. conservative American newspaper

b. $[_{NP}\ [_{NP \rightarrow AP}\ [_{Adj}$ conservative] $[_{NP}$ American]] $[_{NP}$ newspaper]]
'a newspaper for conservative American people'

c. $[_{NP}\ [_{Adj}$ conservative $[_{NP}\ [_{Adj}$ American] $[_{NP}$ newspaper]]]]
'an American newspaper which is conservative'

3.1.2 Context Free Grammar In view of categorical ambiguities between a noun phrase and an adjective (phrase), we need a context-free grammar presented in (5) which includes rewriting rules from an adjective (phrase) into NP. For example, the AP *yellow gold* which modifies *ring* in (1b) is over-written into NP, and then, into the adjective *yellow* and NP which is substituted by *gold*. Therefore, even though *gold* is a noun in its lexical entry, the rule in (5g) substitutes the higher node NP into AP.

(5) A grammar describing a fragment of English L_E:

a.	DP	→	DP	D'
b.	D'	→	D	NP
c.	NP	→	AP	NP
d.	NP	→	A	NP
e.	NP	→	A	N
f.	NP	→	N	
g.	AP	→	NP	
h.	A	→	NP	
i.	A	→	{ yellow, royal, conservative}	
j.	N	→	{ gold, ring, purple, gown, brick, wall, British, newspaper}	

3.2 Structural Ambiguity

Structural ambiguity in propositional phrase attachments has been studied by a number of researchers. Hindle and Rooth (1993) present corpus-based analysis of PP disambiguation for a sentence as in (6):

(6) I saw the man $[_{PP}$ with the telescope].

The PP *with the telescope* may either modify the DP *the man* or the VP *saw the man*. The possessor of the telescope is the man in the former and the speaker in the latter.

Likewise, double PP attachment to a noun phrase creates structural ambiguities as well.

(7) a. a picture of Chomsky in Boston

[1] *Brick wall* is not a noun compound as the stress pattern suggests: *bríck wàll, √brìck wáll.

b. [$_{DP}$ a picture [$_{PP}$ of [$_{DP}$ Chomsky [$_{PP}$ in Boston]]]]
'a picture of Noam Chomsky who is in Boston (the picture is in the Semantics Lab at Stony Brook University'
c. [$_{DP}$ [$_{DP}$ a picture [$_{PP}$ of Chomsky] [$_{PP}$ in Boston]]]
'Chomsky's picture exhibited in Boston (Chomsky himself is elsewhere)'

Similarly to PP attachment, double prenominal possessives are structurally ambiguous. We will analyze the following two patterns: prenominal double possessives and prenominal adjective-possessive combination.

3.2.1 Prenominal Double Possessives Double prenominal possessive (genitive) phrases demonstrate structural ambiguities. The first possessive phrase may either modify the noun in the following possessive phrase or the noun that two possessive phrases modify. The possessor of *a scarf* is *a dog* in (8b) and *Mary* in (8c).

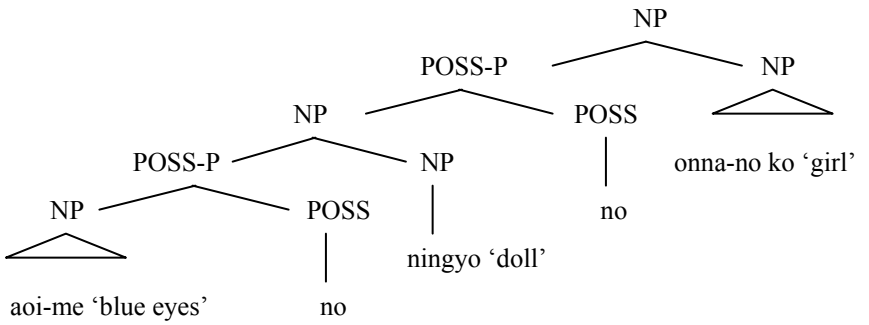
(8) a. Mary's dog's scarf
b. [$_{DP}$ [$_{DP}$ Mary's dog][$_{D'}$ [$_{D}$'s][$_{NP}$ scarf]]]
'A scarf of Mary's dog'
c. [$_{DP}$ [$_{DP}$ Mary][$_{D'}$ [$_{D}$'s][$_{DP}$ [$_{DP}$ dog] [$_{D'}$ [$_{D}$'s][$_{NP}$ scarf]]]]]
'Mary's scarf which is the kind that dogs usually wear'

In the Japanese example (9a), the possessor of blue eyes is a doll in (9b) and a girl in (9c) because *aoi-me-no* 'blue eyes' modifies *a doll* in the former and *a girl* in the latter. The second genitive phrase *ningyo-no* 'doll's' is adjectival in (9c), while it is parsed as a possessive phrase in (9b) where the preceding *aoi-me-no* 'blue eyes' modifies only the NP *ningyo* 'doll.'

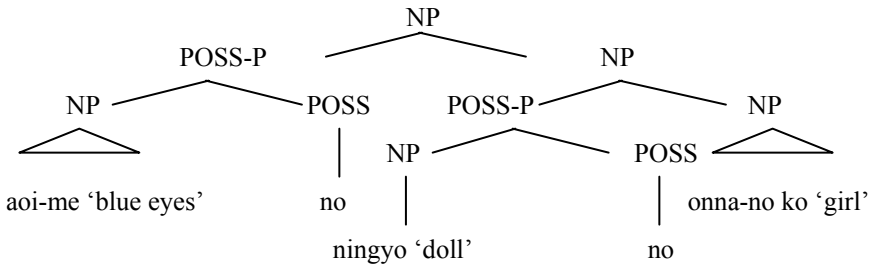
(9) a. aoi me-no ningyo-no onna-no ko
blue eye-GEN doll-GEN female-GEN child
b. [$_{NP}$ [$_{POSS\text{-}P}$ [$_{NP}$ [$_{POSS\text{-}P}$ [$_{NP}$ aoi me]-no] [$_{NP}$ ningyo]]-no] [$_{NP}$ onna-no ko]]
'a girl who has a doll with blue eyes'
c. [$_{NP}$ [$_{POSS\text{-}P}$ aoi me-no] [$_{NP}$ [$_{POSS\text{-}P}$ ningyo-no] [$_{NP}$ onna-no ko]]]
'a girl with blue eyes who carries a doll'

Example (9a) can be parsed in the following two ways.

(10) a.



b.



Another example, (11a), is semantically ambiguous in two ways (11b-c).

(11) a. Tokyo-no tomodachi-no fuku
Tokyo-GEN tomodachi-GEN cloth
b. A cloth of my friend which is kept in Tokyo (the friend is in Osaka and her cloth is in Tokyo)
c. A cloth of my friend who lives in Tokyo (The friend is in Tokyo and her cloth is in Osaka)

3.2.2 Prenominal Adjective and Possessive The adjective-possessive sequence produces structural ambiguities, too.

(12) a. okina aoi ie-no hito
big blue house-GEN person
b. [$_{NP}$ [$_{Adj}$ okina] [$_{NP}$ [$_{POSS\text{-}P}$ aoi ie-no] [$_{NP}$ hito]]]
‘a big man who lives in a big blue house’
c. [$_{NP}$ [$_{POSS\text{-}P}$ [$_{NP}$ [$_{Adj}$ okina] [$_{NP}$ [$_{Adj}$ aoi] [$_{NP}$ ie]]]-[$_{POSS}$ no]] [$_{NP}$ hito]]
‘a resident of a big blue house’

(13) a. ataraishii Toyota-no kuruma
new Toyota-GEN car
b. [*NP* [*Adj* atarashii] [*NP* Toyota-no kuruma]]
'a new Toyota car'
c. [*NP* [*POSS-P* [*NP* [*Adj* atarashii] Toyota]-no] kuruma]
'a car made by new Toyota'

(14) a. Utsukushii Nihon-no Watashi
Beautiful Japan-GEN me
(*Utsukushii Nihon-no Watashi: Sono Josetsu*, Yasunari Kawabata, translated by Edward G. Seidensticker, 1969)
b. Me in beautiful Japan
c. Beautiful me in Japan

3.2.3 Context Free Grammar The following grammar produces structurally ambiguous trees as in (10).

(15) A grammar describing a fragment of Japanese L_J :

a.	NP	→	POSS P	NP
b.	NP	→	Adj	NP
c.	POSS P	→	NP	POSS
d.	POSS	→	*no*	
e.	N	→	{me, onna, ko}	
f.	Adj	→	{okina, aoi}	

The structural ambiguities of the POSS-P attachment can be resolved by corpus analysis as well, i.e., by assigning probabilities at syntactic nodes.

4 THE MEANING DISAMBIGUATION OF JAPANESE GENITIVE MARKER

4.1 Various Possessive Relations and Argument Reversal

The relation denoted by English *'s* is ambiguous among possession (*John's car*), part-whole relation (*John's hand*), agentive (*John's book*, John is the author) and pragmatic interpretation (*a ladies' room*) whose relation is hard to predict (Partee 1997, Barker 1995, Taylor 1996, Vikner and Jensen 2002). The Japanese genitive marker expresses an even wider range of relations between two entities than in English. "NP1-GEN NP2" expresses not only possession as in *John's pen* and part-whole relation as in *John's leg*, but also location, accompaniment, property and quantity. Since the possessive marker denotes more relations in Japanese, the denotation of the relation R is underspecified.

(16) $\| no \| = \lambda x.\lambda y.R(y)(x)$

(17)

a. **possession**: R = {< x, y >| x owns y}	(18) Tanaka-no kaban Tanaka-GEN bag 'Tanaka's bag'
b. **part-whole**: R = {<x, y>| y is part of x}	(19) Tanaka-no te Tanaka-GEN hand 'Tanaka's hand'
c. **location**: R = {< x, y>| y is in x}	(20) Tokyo-no tomodachi Tokyo-GEN friend 'a friend in Tokyo'
d. **accompaniment**: R = {< x, y>| y carries x}	(21) akai kaban-no hito red bag-GEN person 'a person who carries a red bag'
e. **property**: R = {<x, y>| x is dominant characteristic of y}	(22) maho-no kuni magic-GEN country 'a magic country' (23) kaban-no Tanaka bag-GEN Tanaka 'Bags Tanaka' (a bag shop) (24) supa-no Maruetsu supermarket-GEN Maruetsu 'Supermarket Maruetsu'
f. **quantity**: R = {< x, y >| the quantity of y is x}	(25) 2-satsu-no hon-no nedan 2-cl-GEN book-GEN price 'the price of two books' (26) Takusan-no Nihonjin-no tokei many-GEN Japanese-GEN watch 'many Japanese watches / the watch that many Japanese wears'

Note the reversal of the possessor argument between (18) and (21)(23). The possessor argument is NP1 in (18), as in the English possessive *Tanaka's bag,* whose possessor argument is *Tanaka*. On the contrary, in (21) the possessor of the bag is NP2 *hito* 'person.' In English, *red bag's person* would not mean someone who carries a bag. In (21) *Kaban-no Tanaka* 'Bags Tanaka,' *Tanaka* is a shop which sells a bag, and therefore the possessor of a bag.

As shown in (27), some Japanese genitives correspond to English noun compounds, such as *magic land* and *2 kg computer* than to possessives. However, location and accompaniment relation are unique to Japanese and cannot be expressed by neither possessive nor compounds in English.

(27)

	Japanese possessive	**English possessive**	**English compound**
a. **possession**	Tanaka-no pen	Tanaka's pen	*Tanaka pen
b. **part-whole**	Tanaka-no kao	Tanaka's face	*Tanaka face
c. **location**	Tokyo-no shinseki	*Tokyo's relative	Tokyo relative
d. **accompaniment**	boshi-no fujin	*the hat's lady	*the hat lady
e. **property**	inu-no onna-no ko	*dog's girl	*dog girl (a girl dog)
f. **quantity**	2-kiro-no pasokon	*2 kg's computer	2 kg computer

4.2 Problems with Deriving Various Possessive Relations from Possessor Nouns

Possessive relations are ambiguous in both English and Japanese. For example, there is more than one interpretation available for *Tanaka-no hon* 'Tanaka's book.' *Tanaka's book* may refer to the book that Tanaka owns or the book that Tanaka wrote (Barker 1995,87).

Langacker (1993) considers ownership to be the prototypical meaning of the possessive construction and other relations to be the instantiations.

Partee (1997) analyzes possessive relations in two kinds: a free relation R that is contextually supplied and inherent relations inherited from relational nouns, e.g., *brother*, *employee*, and *enemy*. For example, *brother* is inherently relational and its lexical entry would be: $\lambda x.\lambda y.[\text{father-of}'(x)(y)]$. The possessive phrase *John's* in *John's brother* would have the following lexical entry:

(28) Syntax: [John's]$_{NP/TCN}$ (TCN: transitive common noun)
Semantics: $\lambda R.\lambda P.[\exists x[\forall y[R(j)(y) \leftrightarrow y = x] \wedge P(x)]]$

(29) Syntax: [[John's]$_{NP/TCN}$ [brother]$_{TCN}$]$_{NP}$
Semantics: $\lambda R.\lambda P.[\exists x[\forall y[R(j)(y) \leftrightarrow y = x] \wedge P(x)]](\lambda s.\lambda t.\text{brother-of}'(s)(t))$
$= \lambda P.[\exists x[\forall y[\text{brother-of}'(j)(y) \leftrightarrow y = x] \wedge P(x)]]$

Possessive relation in (18) is prototypical and part-whole relation in (19) can be derived lexically from a possessee nominal *te* 'hand' (Barker 1995). However, other possessee nominals are not necessarily relational. *Tomodachi* 'friend' (20) and *shinseki* 'relative' (27c) are relational, i.e., *friend-of x / relative-of x*, but the relation between NP1 and NP2 is not *friend-of'* or *relative of'* but of location, namely, NP2 *is in* NP1. As long as we only consider NP2 and apply (29), there is no way to derive location, accompaniment, property and quantity relations.

Vikner and Jensen (2002) suggest type-raising even non-inherent nouns by

creating an argument slot taken from the Qualia Structure in Pustejovsky (1995). This method systematically derives unambiguous relations which were considered to be contextually given in Partee (1997). It does predict the relation *x weighs y* in *2kg-no pasokon* '2 kg computer' in (27f). The non-inherently relational noun *pasokon* 'personal computer' may type-shift into relational noun in consideration of its constitutive role, i.e., a computer has its own weight. Following Vikner and Jensen (2002), Q_C is a type-raising function from a word to a relational noun with an unsaturated argument slot.

(30) a. **pasokon** 'personal computer'
Argument Structure = x: electronic device
Qualia Structure = [TELIC: λx.λy.[use'(x)(y)]
CONST: λz.λx.[weigh'(z)(x)]]

b. Q_C(pasokon) = λz.λx.[weigh'(z)(x) ∧ computer'(x)]

This item-weight relation substitutes free R between NP1 and NP2. Any 'inherent' telic (purpose), argument, constitutive or formal roles are eligible to create their own argument slots in nouns. Thus, the meaning of *2 kg computer* is computable.

However, accompaniment and property relations do not derive from the Qualia Structure of the possessee noun. *Fujin* 'a lady' does not inherently carry a hat, so it is difficult to consider carrying or wearing as a part of the Qualia Structure. The relation between *Tanaka* and its trade is hard to derive without *comparison* with the possessor noun. Therefore, I propose that Japanese possessives need to consider the argument structure of the possessor noun.

4.3 Relation Disambiguation by Possessor Noun: Type-Shifting Possessor into a Relational Noun

In (20)-(26), it is the possessor nominals than the posssessee nominals that carry more information about relations between two arguments. For example, *Tokyo* is a location, *a bag* is something to carry with, and *onna* 'woman' and *2-kiro* '2 kg' are properties. Even though these nouns are not lexically relational as *brother* is, our world knowledge that *Tokyo* is a location, *a hat* is a thing to wear, *female* is a property and *2 kg* is a weight assigns accompaniment, locative, and property interpretations to the possessive construction.

Therefore, we need to consider the argument structures of non-relational possessor nouns and apply the type-shifting operators to the possessor noun in Japanese. As stated earlier, Vikner and Jensen (2002) apply the Qualia Structure (Pustejovsky 1995) of the possessee noun and type-shift the possessee noun into a relational noun. For example, *John's poem* can be interpreted as 'the poem that John composed' by the meaning shifting operator Q_A that raises *poem* into a two-place holder (31). Then, the type-shifted NP2 combines with the possessive NP1 and the authorship relation is

derived.

(31) Q_A(poem) = $\lambda x.\lambda y.[poem'(x) \wedge compose'(x)(y)]$

The possessive relations in Japanese are derived from either the Argument Structure or the Qualia Structure of possessor nouns.

(32) **Tokyo**
ARGSTR = [ARG_1 = x: location]
QUALIA = [FORMAL = x]

(33) **boshi** 'hat'
ARGSTR = [ARG_1 = $\lambda x.$accessory'(x)]
QUALIA = [FORMAL = x, TELIC = wear'(x, y)]

(34) 2 **kiro** '2kg'
ARGSTR = [ARG_1 = x: weight]

The function A_1 type-shifts Tokyo into a function from its resident into Tokyo (35c). *No* composes with A_1(Tokyo) and forms a determiner which carries a location relation between Tokyo and the relative. As for *boshi-no fujin* 'the lady with a hat (hat's lady),' the telic quale provides a wearer (36). *2 kg* is the weight of something so that 2kg is type-raised into a predicate. *2 kg–no* then becomes a definite determiner which picks a unique wearer.

(35) Tokyo-no shinseki 'The relative in Tokyo (lit. Tokyo's relative)'
a. Tokyo: t
b. $A_1 = \lambda x.\lambda y.in'(x, y)$
c. A_1(Tokyo) = $\lambda y.in'$ (t, y)
d. no(A_1(Tokyo)) = $\lambda P.\lambda Q.\exists!x[[\lambda y.in'(t, y)](x) \wedge P(x) \wedge Q(x)]$
e. no: $\lambda R.\lambda P.\lambda Q.\exists!x[R(x) \wedge P(x) \wedge Q(x)]$

(36) a. boshi: $\lambda x.$hat(x)
b. Q_T(boshi) = $\lambda x.\lambda y.[hat'(x) \wedge wear'(x)(y)]$
c. no(Q_T(boshi)) = $\lambda P.\lambda Q.\exists!x,y[hat'(x) \wedge wear'(x)(y) \wedge P(y) \wedge Q(y)]$
d. no = $\lambda R.\lambda P.\lambda Q.\exists!x,y[R(x)(y) \wedge P(y) \wedge Q(y)]$

(37) a. 2 kg: x
b. A_1 (2 kg) = $\lambda x.$[weigh 2kg'(x)]
c. no(A_1 (2 kg)) = $\lambda P.\lambda Q.\exists!x[[\lambda y.$weigh 2 kg'(y)](x) $\wedge$ P(x) $\wedge$ Q(x)]

Thus, the various relations are inherited from the lexical input of possessor nouns. The argument and Qualia Structure of possessor nouns makes possessor nouns one- or two-place predicates.

5 CONCLUSION

This paper analyzed categorical, structural and semantic ambiguities of prenominal possessives and adjectives. The context free grammar rewrites an adjective into a noun, such that structural ambiguities come to exist. The sense disambiguation of Japanese possessives necessitates type-raising of the possessor noun, depending on the argument structure.

REFERENCES

Barker, Chris (1995) *Possessive Description,* CSLI Publications, Stanford.

Hindle, Donald and Mats Rooth (1993) "Structural Ambiguity and Lexical Relations," *Computational Linguistics* 18, 103-120.

Langacker, Ronald W. (1993) "Reference-point Constructions," *Cognitive Linguistics* 4, 1-38.

Partee, Barbara H. (1997) "Genitives: a Case Study," Appendix to Theo M. V. Janssen, "Compositionality," *Handbook of Logic and Linguistics,* Elsevier Science Publishers, Amsterdam.

Poesio, Massimo (1991) "Relational Semantics and Scope Ambiguity," *Situation Semantics and Its Applications*, volume 2, 469-497, CSLI, Stanford.

Poesio, Massimo (1996) "Semantic Ambiguity and Perceived Ambiguity," *Semantic Ambiguity and Underspecification,* CSLI, Stanford.

Pustejovsky, James (1995) *The Generative Lexicon,* MIT Press, Cambridge.

Taylor, John R. (1996) *Possessives in English: An Exploration in Cognitive Grammar*, Clarendon Press, Oxford.

van Deemter, Kees (1991) *On the Composition of Meaning,* PhD Thesis, University of Amsterdam.

Vikner, Carl and Per Anker Jensen (2002) "A Semantic Analysis of the English Genitive. Interaction of Lexical and Formal Semantics," *Studia Linguistica* 56, 191-226.

Sumiyo Nishiguchi
lev410ns@ecs.cmc.osaka-u.ac.jp